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Improving Patient Adherence: A Look at Causal Knowledge, Treatment Credibility, and Treatment Expectancy

Kyra L. Mackenzie
The University of Western Ontario, kmacke33@uwo.ca

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Kyra L. Mackenzie

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Department of Psychology
University of Western Ontario
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Thesis Advisor: Dr. Leora Swartzman, Ph.D.

Abstract

Lack of patient adherence to Cardiac Rehabilitation programs is a commonly reported problem (Bryne, Walsh, & Murphy, 2005) and is associated with increased morbidity and re-hospitalization rates (Platt, Green, Jayasinghe, & Morrissey, 2014). Factors that can increase the perceived credibility and expectancy of a treatment program predict better adherence (Nock, Ferriter, & Holmberg, 2007). A better understanding of a treatment rationale may improve treatment credibility and expectancy. For this study, causal knowledge is examined as a way to increase understanding because it has been shown to increase acquisition and retention of novel medical information (Goldszmidt, Minda, Devantier, Skye, & Woods, 2011). This study examined whether provision of causal knowledge as an educational strategy influences treatment credibility and expectancy. Patient education sessions at a cardiac rehabilitation program were randomized to deliver either standard care materials (control group) or standard care with the addition of causal information (intervention group). Treatment credibility and expectancy were measured using the Patient Treatment Credibility and Expectancy Measure (PCEM). Ninety-four cardiac patients (*M age* = 66.01, 69.35% male) participated in the study. Those in the intervention group ($n = 45$) provided significantly higher treatment credibility ratings for the cardiac rehabilitation program than did those in the control group ($n = 49$), $t(85.63) = -2.35$, $p = .021$. Findings from this study will inform the patient care delivery at the cardiac rehabilitation program and hopefully will help to increase adherence.

Improving Patient Adherence: A Look at Causal Knowledge, Treatment Credibility, and Treatment Expectancy

Coronary artery disease (CAD) occurs when the heart does not receive sufficient oxygen and blood for optimal functioning due to a diseased artery (U.S. Department of Health and Human Services, 2015). Arteries can become damaged by risk factors such as cigarettes, inadequate exercise, excess weight and high blood pressure (Go, Mozaffarin, Roger, Benjamin, & Berry, 2014). An unhealthy artery has a build-up of plaque (i.e., a fatty substance) and is unable to expand in response to physical exertion. These two negative qualities in an artery can cause symptoms like angina and shortness of breath, and can result in myocardial infarctions, also known as heart attacks (U.S. Department of Health and Human Services, 2015).

Individuals who have had a cardiac event caused by CAD, (e.g., heart attack, surgery, or other medical interventions) often are referred to Cardiac Rehabilitation and Secondary Prevention (CRSP) programs (Bryne, Walsh, & Murphy, 2005). According to Bryne and colleagues (2005), the main purpose of CRSP programs is to help patients recover from their cardiac event and prevent future recurring cardiac events. This is accomplished by helping patients manage cardiac risk factors such as, high blood pressure, smoking, alcohol consumption, stress, depression, cholesterol and physical fitness (Smith, Benjamin, Bonow, Braun, Creager, Franklin, et al., 2011). CRSP programs offer medical evaluations, exercise programming, nutritional guidance, and psychological services following evidence-based guidelines (Smith et al., 2011; Taylor, Wilson, & Sharp, 2011). The service is provided on an outpatient basis for duration of six to eight months. Patients work with interdisciplinary teams that include cardiologists, nurses, dieticians, psychologists, and kinesiologists to maximize their recovery process.

There is evidence that cardiac patients who complete CRSP programs have a lower risk of experiencing future cardiac events (Campbell, Ritchie, Thain, Deans, Rawles, & Squair, 1998; Cupples & McKnight, 1994). Across multiple studies, it has been shown that CRSP can decrease all-cause mortality by 20 to 32 percent, regardless of the cause of death (Beauchamp, Worcester, Ng, Murphy, Tatoulis, Griss, Newman, & Goble, 2013; Jollieffe, Rees, Taylor, Thompson, Oldridge, & Ebrahim, 2004). That is, patients who regularly attended their CRSP sessions had better survival rates than medically similar individuals who did not enroll in the program. In another study Campbell and colleagues (1998) found that lifestyle changes, for instance, eating a healthier diet and moderate exercise was most effective for reducing the death rate of CAD. Their studies showed that exercising reduced sudden deaths by 36 percent and overall mortality rates by 20 percent.

Despite the well-documented benefits of CRSP programs for cardiac patients, adherence to the program is generally poor (Jolly, Bradley, Sharp, Smith, Thompson, Kinmonth, & Mant, 1999; Feder, Griffiths, Eldridge, & Spence, 1999). In particular, many patients do not take their prescribed medicine as directed and/or they do not follow recommended lifestyle changes, such as dietary and exercise regimens (McAlister, Lawson, Teo, & Armstrong, 2001). One study found that, of the 72 percent of cardiac patients indicating an intention to participate in cardiac rehabilitation, only 40 percent attended all rehabilitation (Cooper, Lloyd, Weinman, & Jackson, 1999). This was a cause for concern considering that the risk of re-hospitalization and death is much higher for individuals who are non-adherent to CRSP guidelines (Go et al., 2014; Platt et al., 2014).

The literature shows that adherence is affected by a lack of patient education as well as age-related cognitive abilities (Zhang, Swartzman, & Minda, 2014). Jackson, Leclerc, Erskine

and Linden (2005) found that patient participation was an important predictor of adherence in CRSP programs. In other words, patients were more likely to follow recommended lifestyle changes (i.e., exercise) outside of the program if they were active participants in the program. They also found that the extent to which patients could learn and understand the materials provided to them in the program, determined whether they were active participants. This suggests that the manner in which patient education is delivered has implications for retaining patients in the program.

Past studies have shown that patient education has a large influence on adherence rates (Clark, Karagoz, Apikoglu-Rabus, & Izzettin, 2007). For example, those who received patient education about HIV medication were more likely to adhere than those in a control group that contained no information on the HIV medication (Goujard, Bernard, Sohier, Peyramond, Lancon, Chwalow et al., 2003). There has been mixed evidence in the success of patient education in improving adherence, and these differences could be due to ineffective teaching strategies. Different ways of delivering the education could affect patients' education and adherence. Inserting causal information into the pedagogy may be one way to accomplish this task.

Causal Knowledge and Adherence

Research that has examined how to best deliver patient education has looked at causal knowledge as a variable that might improve patient adherence (Murphy & Medin, 1985). Causal knowledge pertains to *why* a certain event happens or the underlying explanation of *how* something works (Keil, 2006). Woods, Brooks and Norman (2007) did a study to determine whether providing biomedical knowledge improved clinicians' diagnoses, spurred by Patel and Kaufman's 'Two Worlds Hypothesis' (Patel & Kaufman, 2002). This hypothesis stipulates that

biomedical knowledge learned in medical school was not used in everyday clinical situations. Patel and Kaufman (2002) noticed that clinicians seldom used biomedical knowledge while making diagnoses. Woods and colleagues (2007) examined this notion in a study that had two groups diagnose neurological categories. Group one had biomedical and clinical information and group two just had the clinical information. When they were both tested immediately, they did equally well. When tested one week later, the group with clinical and biomedical knowledge did significantly better. Woods and colleagues (2007) reasoned that the basic science was needed to explain the causal relation, and the causal connections between clinical features helped participants retain the information. Participants were tested again without review of the information. The researchers found the participants who received causal information not only retained more but also performed seven percent better than their own initial test. This supported, again, the theory that knowledge about basic science mechanisms helped students understand the given information. More specifically, explanation of why a certain sign and symptom went together helped students build a mental representation of the neurological categories.

Similarly, another study found that causal knowledge improved the acquisition and retention of novel medical conditions (Goldszmidt, Minda, Devantier, Skye, & Woods, 2011). Undergraduate students with no previous medical knowledge were asked to read information about how to conduct a lung examination and were tested on this information after a one-week delay. The control group received regular information and the intervention group received the same information along with additional causal information. Participants were randomly assigned to either group. The causal information explained *how* sound traveled through healthy lungs and unhealthy lungs. This was in comparison to the control group who received information only about how a healthy and unhealthy lung *should* sound. It was found that those who received the

causal information did significantly better than those who did not on the test of identifying healthy and unhealthy lungs. When tested one week later, the causal information group performed significantly better than the control group. This study suggested that causal information helped individuals make meaningful connections between novel concepts. The provision of causal knowledge enhances rote learning because it makes the link between cause and effect more explicit, making it easier to recall and store the information in memory (Hazlewood & Janes, 2013). Arguably, if causal information could help individuals with no prior medical knowledge learn how to conduct a lung exam, it is possible that causal information could help patients learn health information.

To determine whether causal information could benefit health care users, Zhang and colleagues (2014) examined the ability of younger and older adults (over 65) to understand medical information. The control group received a health booklet with information on a fictitious disease while the experimental group received the same information but with causal information explaining the disease symptoms and self-care behaviours linked explicitly. Both were tested immediately after to see how well they understood the information in the health booklet. Young adults in both causal and non-causal groups performed equally well on the 10 questions that did not require causal knowledge to answer them. However the causal group did significantly better on the critical 15 items on the test, which measured understanding of the material through the use of causal information. They also found that the performance of those who received the causal knowledge did not decline over time, but that of the non-causal groups did. As predicted, older adults performed worse than younger adults. However, contrary to prediction, older adults who received causal explanations did not perform better than those who did not. Zhang and colleagues (2014) attributed this to older adults being more hesitant to learn new medical

information that would go against what they already knew about medical conditions. Nonetheless, these findings suggest causal knowledge could help health information users, such as patients, to better acquire medical knowledge. Yet, it was still unclear whether causal knowledge would benefit a patient population. Furthermore, causal knowledge could be a possible variable that could improve adherence by influencing treatment credibility and expectancy ratings.

Treatment Credibility/Expectancy and Adherence

To determine whether patient education is effective for engaging patients and ultimately improving patient adherence, one commonly studied factor is treatment credibility and expectancy. Treatment credibility is an individual's assessment of how believable, credible, or logical a given treatment is (Kazdin, 1979). Expectancy refers to what a person believes will be accomplished (Devilly & Borkovec, 2000). It has been proposed that the terms credibility and expectancy, while often used interchangeably, are different constructs. It has been found that certain therapies receive divergent ratings of credibility and expectancy from participants and that, in general, credibility was less predictive of an outcome than expectancy. Devilly and Borkovec (2000) noted that credibility is more of a logical thought process and expectancy is more of an affective response like hope or faith in a therapy. Nock, Ferriter, and Holmberg (2007) examined parents' beliefs about treatment credibility based on programs their children were going through and evaluated how treatment credibility ratings correlated with parent's adherence to the program. They found that parents who thought the treatment was valid (treatment credibility) were more willing to change their ways based on the treatment's instructions. The parents who had high expectations (treatment expectancy) that the treatment would change their kids for the better were more likely to follow the instructions as well. Nock

and colleagues (2007) suggested that the parents who had higher expectations might have also been more committed to an outcome. Thus, they felt obligated to continue with the program. The implications of this study suggest treatment credibility and expectancy had the ability to increase adherence rates. However, what was unclear in this study was what affected treatment credibility and expectancy ratings.

Overall, it is believed that if people can take control of their illness and respond to the problems it is presenting, they would be more likely to adhere to the treatment along with a reported higher self-efficacy (Taylor et al., 2011). If increasing treatment credibility allows people to perceive the treatment as logical and reasonable, their beliefs could in turn lead them to become more likely to complete and follow the treatment program. As mentioned earlier, research (Goldszmidt et al., 2011; Zhang et al., 2014) has shown that those who received causal information about a health condition were better able to apply novel information about that condition. This suggested that individuals who learned about the cause-effect of their illness conditions might have been better able to understand the rationale for following prescribed health regimens. However, causal information has never been applied in a patient context.

Further research on the use of causal information in a patient population may help improve the delivery of patient education programs. Additionally, Taylor and colleagues (2011) noted that many studies are prone to methodological errors because they use self-reports to record adherence. Adherence is likely to elicit a response bias because individuals do not want to be deemed as a ‘bad patient’. One way to circumvent this issue is to assess treatment credibility and expectancy. Treatment credibility and expectancy examine patients’ expectations and attitudes about a given treatment program. It would be expected that an individual who rated a program as highly credible and expected a lot out of a program would be more inclined to participate in the

program. As such, it would be important to introduce interventions that could improve patients' ratings of treatment credibility and expectancy. To date, there are no patient educational interventions aimed to improve treatment credibility and expectancy.

The present research examined the effects of causal information on patient's perception of a CRSP program. The overall goal of this research was to increase overall adherence in CRSP programs, which would ultimately lead to a lower mortality rate of people with CAD. The participants of this study were patients who had CAD and/or had received a medical intervention. A common misperception in this population was that most patients believed that their medical intervention, such as heart surgery, was the ultimate fix. The purpose of the patient education session at the CRSP program was to help patients understand that they required interventions to reduce or eliminate the risk of experiencing another cardiac event due to their heart disease. The reasoning was that if patients better understood *why* the recommendations for cardiac rehabilitation (e.g. exercise and a changed diet) were being made, they would be more likely to believe that CRSP works. That is, we expected that patients armed with causal explanations as to why the behavioural recommendations associated with the CRSP program (e.g., exercise) should impact on the pathophysiology underling their heart disease would regard the CRSP program as more credible and would expect it to deliver a better treatment outcome than those who did not receive this rationale.

Current Study

The main study objective was to determine whether provision of causal information (independent variable) would enhance ratings of treatment credibility and expectancy (dependent variables). It was hypothesized that patients who received the causal knowledge in their CRSP orientation session would have a significantly higher treatment credibility rating than their

counterparts. It was also hypothesized that patients who received causal knowledge in their CRSP orientation session would have a significantly higher treatment expectancy rating than those in the control group. It was hoped that the study findings would help inform the planning of patient education sessions at the CRSP program.

Methods

Participants

A total of 94 participants completed this study and were pre-randomized into either the control (n = 49) or intervention group (n = 45). The control group (M *age* = 67.57 ± 9.01, SD = 9.00) had slightly older participants than the intervention group (M *age* = 64.56 ± 10.57, SD = 10.57). Randomization of the orientation sessions followed a computer-generated number sequence. Participants were adult cardiac outpatients invited to attend an orientation session at the Cardiac Rehabilitation and Secondary Prevention (CRSP) program at St. Joseph's Hospital, London, ON. All demographic information on the participants was taken from their medical chart that had been inputted into the hospital system. Inclusion criteria included oral and written fluency in English and diagnosis of a cardiovascular disease. Patients' health records were accessed both to verify that they had a heart condition and to gather demographic information. A total of 262 patients were approached for the study and surveys were returned from 94, for a response rate of 30.2 percent.

Materials

The Patient Treatment Credibility and Expectancy Measure (PCEM). This was a slight adaptation of the original measure developed by Devilly and Borkovec (2000). The measure they created was the Credibility/Expectancy Questionnaire (CEQ). The CEQ is a six-item questionnaire with the first three questions pertaining to treatment credibility and the latter

three pertaining to treatment expectancy. The CEQ was adapted for use among a cardiac population, and each item used a scale that ranged from 1 to 9. A sample credibility item was, "at this point in time, how much *sense* does the CRSP program make to you? (1 = not a lot of sense and 9 = a lot of sense). A sample expectancy item was, "how much do you really *feel* that the program will help you reduce your symptoms and risk of heart disease? (1 = not at all and 9 = is very much). The CEQ has been found to be a valid and reliable measure, Chronbach's $\alpha = 0.86$. (Devilly & Borkovex, 2000).

Demographic Characteristics. Demographic information was collected using patients' chart review from their medical records.

Group Condition. The control group received the regular rehabilitation session explaining CAD, including a brief explanation of the pathophysiology, and *what* recommended lifestyle changes they should follow to help rehabilitate, along with a sheet giving more information on this subject. For the intervention group, causal information was given through an additional 10 minutes in the PowerPoint presentation and through the use of a pamphlet. This information explained *how* the lifestyle changes that were recommended could affect the pathophysiology of their arteries. An example of this would be an explanation that moving muscles through regular physical activity helps to stimulate and repair the damaged endothelium (inner layer of the artery that helps supply blood to the heart) and that when this happens, more nitric oxide is produced, which allows for more blood flow to the heart.

Procedure

Recruitment took place in the orientation session at the CRSP program at St. Joseph's Hospital, London, ON. Potential participants were informed that the purpose of the study was to find ways to improve the CRSP program and fill any gaps that might have gone unnoticed thus

far. All patients attending the session were given the option to take home a survey packet and letter of information which explained the study in more detail. The voluntary nature of participating in the study was also discussed. Implied consent was obtained through completion of the survey packet.

The survey packet contained the Patient Treatment Credibility and Expectancy Measure. A pre-addressed envelope was given to participants, which they used to mail the questionnaires back to the hospital. The letter of information contained a link to the online version of the surveys for those interested in completing the questionnaires that way.

This was a pre-randomized study, meaning every other week the control session was held and the intervention session happened in alternating weeks. Participants either were in the control or intervention group, depending on the day they signed up for orientation.

Results

A chi-square analysis was conducted to compare the demographic characteristics between the control and intervention groups. Chi-square analyses showed no significant differences in demographic characteristics between groups (see Table 1). High internal consistency was found between the items on the PCEM (see Table 2).

An independent t-test was conducted to compare the treatment credibility and expectancy ratings of the control and intervention group. As predicted, the intervention group (M = 24.00, SD = 3.27) provided a significantly higher treatment credibility mean than the control group (M = 22.04, SD = 4.73), $t(85.63) = -2.35$, $p = .021$, though the effect was small ($d = 0.25$). The intervention group (M = 22.84, SD = 3.78) and control group (M = 21.12, SD = 4.87) did not differ significantly on treatment expectancy, $t(92) = -1.90$, $p = .060$ (see Figure 1).

Table 1

Demographic Characteristics

		Control	Intervention	p - value
Gender (%)				.081
	Male	60.9	77.8	
	Female	39.1	22.2	
Living Situation (%)				.466
	Alone	10.3	15.0	
	With Spouse	87.2	77.5	
	With Others	2.6	7.5	
Marital Status (n)				.501
	Single	1	3	
	Widowed	1	2	
	Married	33	31	
Ethnicity (n)				
	White	36	35	
	Other	10	10	
Education Level (%)				.956
	High school or less	41.0	37.5	
	More than high school	59.0	62.5	
Occupation (n)				.107
	Working	5	13	
	Not working/retired	30	23	
	Disability	4	4	

Note. $n = 94$

Table 2

Reliability Analysis of PCEM Questionnaire

	Treatment Credibility	Treatment Expectancy	Overall
Chronbach's Alpha	.853	.942	.925
M (SD)	7.72 (1.51)	7.32 (1.56)	7.53 (1.54)

Note. M = mean; *SD* = standard deviation

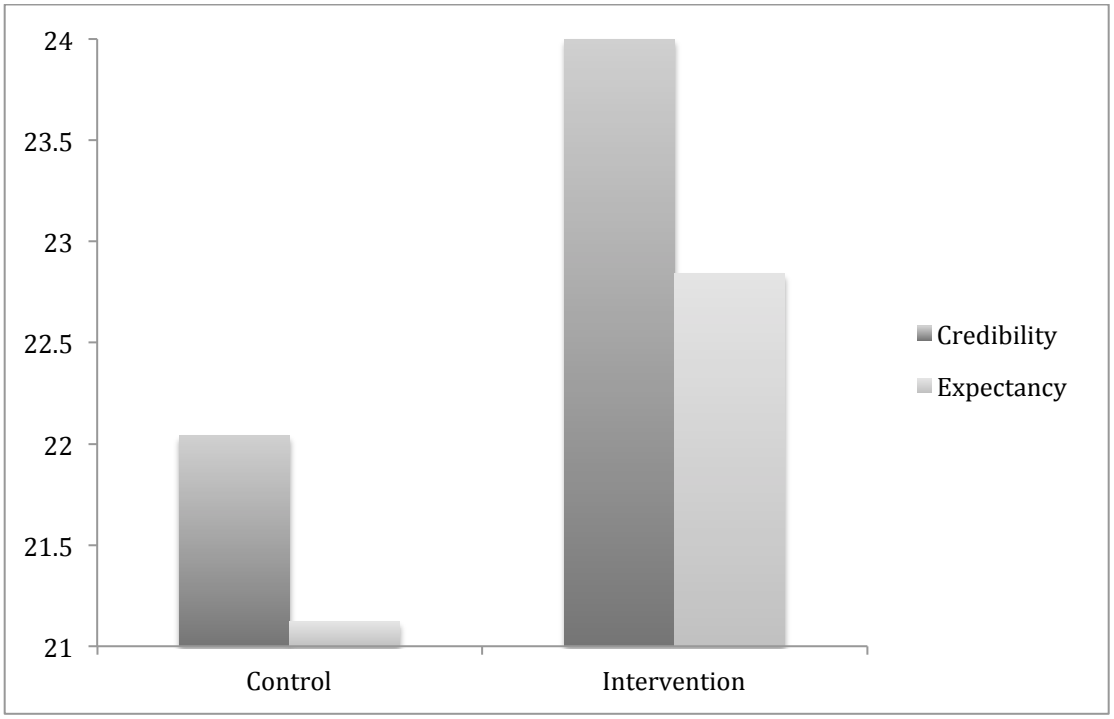

Figure 1. Graph shows the mean scores for treatment credibility and treatment expectancy on the Patient Treatment Credibility and Expectancy Measure between the standard and intervention group.

Discussion

This study is among the first to explore cognitive predictors of treatment credibility and

expectancy. By providing patients with information highlighting the causal link between the illness management behaviours they are asked to adopt and the underlying pathophysiology of their condition, the treatment became more credible for them. This finding is consistent with past studies demonstrating that causal information facilitates deeper processing of new information (Goldszmidt et al., 2011). Considering that treatment credibility refers to an individual's assessment of how believable, credible, or logical a given treatment is (Devilly & Borkovec, 2000; Kazdin, 1979), it could be that providing causal information allowed patients to form a more coherent understanding of the rationale for participating in cardiac rehabilitation. As treatment credibility is postulated to be a cognitive process, it may be more amenable to change as a function of patient education provided. For example, Hundt and colleagues (2013) reported that older adults who received detailed explanations of a treatment rationale were more likely to rate the program as credible for treating anxiety than their counterparts. In the present study, causal information was used to explain how completing aspects of the CRSP program, such as exercising, was directly linked to improvements in arterial health. Arguably, the treatment rationale at cardiac rehabilitation made more logical sense to patients who were in the intervention group in light of receiving this information.

Contrary to predictions, the causal manipulation did not have a statistically significant impact on treatment expectancy, though the group differences were in the predicted direction. The reason for the stronger effect for treatment credibility may be because treatment expectancy, driven more by affective processes, may be less responsive to what is essentially a cognitive intervention. In some situations, people make emotional decisions and disregard the rational and logical part of it (Ohira, 2011). Introducing more affective/motivational components into the patient education intervention may further increase the efficacy of causal information. For

example, Zhang and colleagues (2015) found that heart failure patients were less likely to adhere to illness management recommendations if they failed to perceive the compatibility between recommended health regimens and their valued life goals. Perhaps explaining how illness management could enhance functioning in other life areas (i.e., taking care of grandchildren), in addition to patients' physical health, may improve individuals' expectancy of a treatment program.

Past studies have found that parents who ranked a higher treatment credibility rating and believed the treatment to be more valid were more willing to change their ways for the better and adhere to the given program (Nock et al., 2007). Similarly, people who believed that they could take control of their illness and respond effectively to presenting problems were more likely to adhere to the treatment (Taylor et al., 2011). As such, and not surprisingly, treatment credibility appears to have a positive impact on patient adherence in treatment programs (Devilly & Borkovec, 2000; Nock et al., 2007). The results of this study suggest increasing patients' understanding of the rationale for illness management could be one strategy to enhance treatment credibility. It is possible that the provision of causal information in patient education would improve individuals' adherence to program recommendations.

Limitations

There were several limitations in this study that may have affected the interpretation of the present findings. Only 30 percent of those who attended the initial session completed study questionnaires. It is possible that patients who felt more confident in their knowledge of the CRSP program and who perceived the program more favourably were the ones who completed the questionnaire. Due to the selection bias, there may have been possible ceiling effects for the knowledge and treatment credibility and expectancy scores. Perhaps differences between

intervention and control groups would have been more pronounced if the sample had included all patients who attended the orientation session. In addition, the study did not examine the range of variables that could influence treatment credibility and expectancy. Other variables that could have been looked at could be self-efficacy, depression, or anxiety. People who possibly have a lower self-efficacy or have depression or anxiety may inherently have a more negative outlook on their clinical outcome. Thus, these potential confounding factors may affect their perceived credibility and expectancy of the CRSP program.

Conclusions

Overall, this study showed that there is merit to the approach of including causal knowledge in patient education interventions. Explicitly linking the recommended lifestyle changes in the rehabilitation to the pathophysiology of the heart enabled participants to better understand *why* they were being asked to complete these recommendations rather than just being told what to do with no causal connection. Without the causal connection it seemed the participants had a harder time understanding why these lifestyle changes would help in the recovery of their heart. Causal knowledge has already been established in the literature, so that is why treatment credibility and expectancy are so important to be researched. Future studies should examine whether the use of causal knowledge to increase treatment credibility ratings has an affect on patient health behaviours.

Ultimately, future research should continue to identify ways to increase treatment credibility and look for another variable that might be able to increase treatment expectancy. Moreover, more research should be done on ways to increase patient's causal knowledge. This could lead to an even greater increase in treatment credibility ratings and in turn, greater adherence rates.

Practical Implications

The provision of causal knowledge may help improve the delivery of patient care at the CRSP program. Moreover, educating patients about the causal link between illness management and symptom alleviation could be applied to other medical contexts. Future research should look into testing this theory of causal knowledge increasing treatment credibility in programs that are not medically based since causal knowledge has been shown to increase acquisition and retention in more than just medical contexts.

Another important implication of this research would be the provision of causal information to enhance treatment credibility as a way to help address issues with patient non-adherence in CRSP programs. Causal information may have the potential to increase patient adherence to cardiovascular illness management through the indirect path of enhancing treatment credibility. The link found between causal knowledge and treatment credibility implies that adherence rates would be higher based on the plethora of literature suggesting that a higher treatment credibility rating increases adherence rates. The higher the adherence rates, the lower the death rates and recurring cardiac events. The findings of this study bring us one step closer to increasing adherence rates in CRSP programs, which could ultimately reduce the amount of heart attacks we see in the medical world.

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